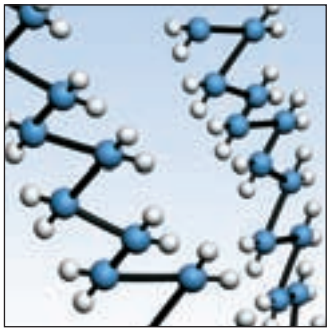
1.1.3 Inner and outer pipe of PE-Xc, quality assured

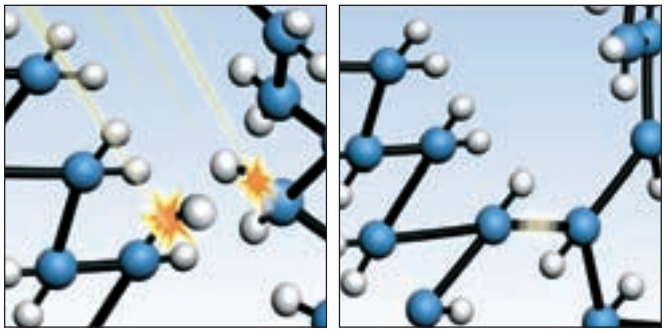
Henco produces multilayer pipes with both the inner and outer pipe consisting of PE-Xc, electron beam cross-linked polyethylene.

PE stands for **polyethylene**
X stands for **cross-linking**
c stands for **electron beam cross-linking**, the process in which the polyethylene is cross-linked



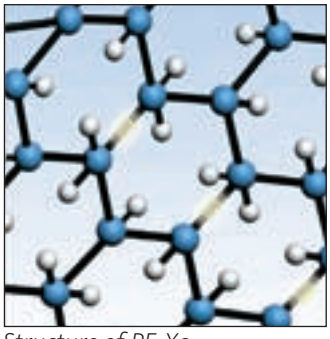
Structure of high density polyethylene

Polyethylene is a plastic that consists of different chains of molecules. These chains are not directly connected to each other. The basic structure is kept together by weak mutual forces between the molecules. When heated the chains move more vigorously and further from each other. As a result, the material becomes softer, more elastic and less pressure-resistant.
Ultimately, it becomes less suitable for sanitary applications or heating.



Cross-linking process by means of electron beams

Exposing the multilayer pipe to intense electron beams causes cross **connection**s between the different molecule chains of the plastic. The electrons cause the oxygen atoms to split from the different polyethylene chains. The carbon atoms are then allowed to join and form a strong cross-linked structure.



Structure of PE-Xc

The cross connections mean the movement of the chains with respect to each other is kept to a minimum. When heat or another form of energy is applied, the strong structure of the pipe will not be distorted. Cross-linked polyethylene displays optimal behaviour under continuous loads due to pressure or temperature. Cross-linking ensures **enormous durability**.

1 PIPES

Cross-linking by way of electron beams is the best and purest way to cross-link polyethylene.

Polyethylene can be cross-linked in the following ways:

a. **PE-Xa**: the so-called Engel process, where the polyethylene is mixed with a high concentration of organic peroxide. The peroxide cause connections to take place between the polyethylene chains. A chemical method.

b. **PE-Xb**: cross-linking originates by the addition of silane to the polyethylene, followed by a water treatment. A chemical method.

c. **PE-Xc**: as distinct from the two last methods, cross-linking takes place during a second process when the pipe is exposed to intense electron beams. The beams excite the polyethylene molecules so much that they cross-link. A physical method.

The German standard DIN 16892 determines the minimum degree of cross-linking for each of the methods.

Cross-linking method		Procedure	
Description	Minimum cross-linking levels according to standard DIN 16892	Physical	Chemical
PE-Xa	70 %		peroxide
PE-Xb	65 %		silane
PE-Xc	60 %	electron beams	

We therefore conclude that a PE-Xa pipe must be 70% cross-linked, a PE-Xb pipe 65% to meet the standard, and a PE-Xc pipe only 60%. The PE-Xc method is also a physical method: no chemical additives are added, so by definition the pipe does not have to be rinsed for sanitary use.